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"Is My Child Safe Online?" - On Requirements for Parental Control Tools in Apps used by Children

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Abstract: Following the Covid-19 pandemic, children have increased their use of mobile electronic devices to access the internet. Among the main applications used by children between 9 and 17 years old are the social and communication media platforms Instagram and TikTok (CGI.br, 2023). Consequently, they are more exposed to risky situations (e.g. objectionable content, sexual predators, cyberbullying, etc). To address this scenario, we conducted a systematic mapping study and a snowballing process evaluating 33 primary studies to identify recommendations and general guidelines for parental control tools, which should be part of any social media app used by children. Based on this study, we derived 16 functional (FR) and 13 non-functional requirements (NFR) for IT companies to develop features that help caregivers and children promote online protection via assertive decisions and proper safeguards. We used those functional requirements as lenses of analysis of the two main social media software platforms largely used by children: Instagram and TikTok. Our findings revealed that TikTok's parental control features are more mature and present more options for supervising and restricting children's online activities than Instagram's. Therefore, this research expands knowledge about the features for parental control and raises the discussion around children's protection and welfare as relevant digital citizens.

Keywords: Parental Control, Children, Requirements, Apps, social media, Features

1 Introduction

After the Covid-19 pandemic, we observed an increase in the use of electronic devices by children, with the proliferation of connected gadgets such as smartphones and tablets in their routines (e.g. in classes, for online interaction with friends or simply for fun - playing games or watching their favorite vlogs). In Brazil, children are becoming familiar with digital technology at an increasingly young age, with a frequent use of the internet – The number of children who had their first access to the internet by the age of 6 increased by 10.5% between 2018 and 2022 CGI.br [2023].

The disparity in the use of mobile devices such as smartphones, tablets, and smart devices (e.g. smartwatches) over other devices (e.g. desktop computers) causes a large use of mobile apps in a regular user's journey CGI.br [2023]. At the same time, one-third of users globally are children UNICEF [2019], which denotes their relevance for IT companies.

In 2022, 86% of Brazilian internet users between 9 and 17 years old already had a profile on at least one social media platform CGI.br [2023]. To ensure children's well-being, avoiding the excessive use of their data and situations that affect their online security, we must understand if their preferred apps provide parental control features. The top-3 social and communication media platforms apps used by Brazilian children aged 9 to 17 CGI.br [2023] is formed by TikTok, Instagram, and Facebook, each one implementing its own parental control features.

According to the Brazilian Society of Pediatrics (*SBP*), children's overexposure to electronic devices at an early age can trigger social, behavioral, sleep, and eating problems, as well as increase anxiety and exposure children to inappropriate content for their age group Penina [2017]. According to The Guardian, former employees of tech companies struggle with safety concerns over their children's use of social media Bhuiyan [2024]. This context reinforces the need for proper knowledge about parental control tools, which represents an option for protecting children in the digital environment.

From the legal perspective, Brazilian Civil Rights Framework for the Internet (in Portuguese: Marco Civil da Internet, officially (Federal) Law No 12.965/2014) regulates the use of the Internet by defining ethical principles and guarantees for the digital environment to be a free and democratic space, with a focus on ensuring privacy and personal data protection BRAZIL [2014]. This legislation reinforces the prohibition of child advertising BRAZIL [1990] and the total priority for the protection of children's rights by society, the state and companies BRAZIL [1988].The Brazil's General Data Protection Law (in Portuguese: Lei Geral de Proteção de Dados Pessoais - LGPD, officially (Federal) Law No 13.709/2018) regulates the processing of children's personal data, establishing among others that their data must be processed in their best interest, and stating the age of consent for data collection as 13 years old BRAZIL [2018].

Internationally, there are two famous important data protection regulations. The Children's Online Privacy Protection Act (COPPA)[1] in the United States, regulates organizations that collect and use data from children under the age of 13. The european General Data Protection Regulation

[1]Children's Online Privacy Protection Act (COPPA) - https://www.ftc.gov/legal-library/browse/rules/childrens-online-privacy-protection-rule-coppa

(GDPR)[2], on the other hand, is a more general data protection regulation, that states children as a vulnerable group needing special protection. Both regulate collection, storage and processing without parental consent of children's personal data under a certain defined age.

In another perspective, social media apps used by young users have age ratings. Highly relevant platforms like Instagram and TikTok, for example, require a minimum age of 13 for registration. However, immature age verification mechanisms enable underage youth to create profiles and start exploring these platforms Pasquale *et al*. [2022]. In addition, these platforms often expose children to advertising and inappropriate content such as pornography, drugs, violence and cyberbullying, or self-harm Dvorak [2024].

Many parents are not familiar with technological tools, including those provided by apps used by their kids, which prevent children from getting proper guidance Matos [2021]. In addition, less than 10 percent of children on Instagram had enabled the parental supervision setting by the end of 2022 Nix [2024]. Therefore, two problems emerge: (i) a lack of assertive communication for the protection of children in the digital environment, and (ii) excessive and unsupervised use of smartphones, the main vector of internet access for young people CGI.br [2023]. This scenario motivated us to explore the following research questions (RQ):

- RQ1 - What are the ideal requirements for parental control features in social media apps used by children?
- RQ2 - What are the key features for parental control offered by social media platforms?"

To address RQ1, we identified the ideal requirements for parental control tools in the literature through a systematic mapping study that encompassed a snowballing process. Our analysis of 33 primary studies enabled the definition of 29 requirements, which we classified in 2 main categories: nonfuctional requirements and functional requirements (categorized into 4 dimensions). As an additional contribution, we addressed RQ2 by using the defined functional requirements to examine features for parental control provided by the two main social media platforms most commonly used by children from 9 to 17 years old: Instagram and TikTok CGI.br [2023]. The research steps were conducted by the first author under the supervision of the second author, an expert in the field of Human-Machine Interaction who reviewed each preliminary result (e.g. he strengthened the study by indicating papers to include in the mapping phase, during snowballing).

The rest of this paper is structured as follows. In Section **??**, we present our conceptual background. Section **??** details the methodology. Sections **??** and **??** present our contribution: (i) the list of requirements for parental control tools, and (ii) their application to examine two social media platforms, TikTok and Instagram. Finally, Section 2 describes the research's impact on academia and practice, together with threats to validity and future work.

[2]General Data Protection Regulation (GDPR) - https://gdpr-info.eu/

2 Conclusion

2.1 Contribution for Research and Practice

This systematic mapping study on parental control tools in social media platforms used by children sheds light on the critical need for robust measures to ensure children's online safety. By examining the requirements for parental control tools and conducting an analysis of the most popular social media platforms among children between 9 and 17 years old (i.e. Instagram and TikTok), it is evident that there is a pressing demand for enhanced features that cater to the specific needs of young users and parents.

Our findings revealed TikTok's parental control features are more mature in regards to Instagram protection features as it presents a varied and wider set of options for supervising and restricting children's online activities than Instagram's. Both platforms totally or partially comply with requirements from *Platform-Parent-Child's dialogue* category encouraging dialogue and considering parent-children opinions while developing these features. However, they still struggle to comply with *Parent-Children's Privacy* requirements, neglecting at least 2 requirements, and providing little information about some privacy concerns in parental control.

We believe our findings are valuable for both academia and industry. By mapping parental control requirements and highlighting areas for improvement in social media platforms, we contribute to the ongoing dialogue on children's safety and education in the digital environment. These results underscore the importance of continuous evaluation and evolution of parental control tools on popular apps to better protect young users from potential risks and vulnerabilities in the digital space. We clarified the concept of parental control tools, and described the main parental control functionalities for children's safety in their preferred apps.

Moving forward, IT companies and policymakers must collaborate in developing comprehensive parental control tools that prioritize children's safety and privacy. The alignment with international standards can provide more mature features and create a safer online environment for young users. This study serves as a possible catalyst for future research and innovation in the field of online child protection, emphasizing the shared responsibility of all stakeholders in safeguarding the well-being of our digital natives.

2.2 Threats to Validity

Even though we had systematically structured our work (e.g. using search string, performing a forward and backward search, extraction spreadsheet, etc.), our search procedure may have overlooked relevant articles, which is a threat to *internal validity*. To address this potential threat, we performed forward and backward searches and relied on expert referral, adding important studies (e.g. outside of our search time frame from 2018 to 2023). In addition, we heavily relied on data information about Brazilian's children internet usage, reducing our scope to this context.

To raise *construct validity*, we had one researcher mapping the data in the papers and another one validating the resultant selection and interpretation. These steps were crit-

ical since we were dealing with subjective evidence, such as non-functional requirements or how a given requirements was implemented by a company/platform.

The final step of our data collection, during the search process, involved the review of results by a single expert. This fact represents a possible threat to *external validity*, though we relied on his experience with the methodology (the second author had performed around ten mapping studies) and topic (in recent years, he supervised several students on children's rights, protection and security by tech companies).

2.3 Future Work

Our upcoming studies aim to enrich the set of requirements by analyzing gray literature (e.g. governmental reports, relevant IT news portals and large-circulation outlets, specialists' recommendations for Parental Control solutions providers, recognized non-governmental institutions, etc) that could bring more features. We will also discuss the results with representatives of the two companies (i.e. Meta's Instagram and Bytedance's TikTok) based on collaboration with institutions such as the Alana Institute and Fairplay, which hold a direct dialogue with such players.

Authors' Contributions

João Victor Assis contributions: conceptualization, data curation, formal investigation methodology, project administration, writing – original draft.

George Valença contributions: conceptualization, data curation, formal investigation, methodology, project administration, validation, writing – original draft.

References

Bhuiyan, J. (2024). 'fundamentally against their safety': the social media insiders fearing for their kids. *The Guardian*. (accessed 07 February 2024).

BRAZIL (1988). Constituição da república federativa do brasil. (accessed 22 April 2023).

BRAZIL (1990). Lei nº 8.078. dispõe sobre a proteção do consumidor e dá outras providências. (accessed 22 April 2023).

BRAZIL (2014). Lei nº 12.965. estabelece princípios, garantias, direitos e deveres para o uso da internet no brasil. (accessed 22 April 2023).

BRAZIL (2018). Lei nº 13.709, lei geral de proteção de dados pessoais (lgpd). (accessed 07 February 2024).

CGI.br (2023). Pesquisa sobre o uso da internet por crianças e adolescentes no brasil: Tic kids online brasil. (accessed 30 January 2024).

Dvorak, P. (2024). These are the parents who stared down mark zuckerberg: They believe social media helped harm or kill their kids, and they're asking for regulation. *The Washington Post*. (accessed 07 February 2024).

Matos, M. C. (2021). Redes sociais para crianças menores de 13 anos: qual o impacto? (accessed 25 April 2023).

Nix, N. (2024). Meta says its parental controls protect kids. but hardly anyone uses them. *The Washington Post*. (accessed 07 February 2024).

Pasquale, L., Zippo, P., Curley, C., O'Neill, B., and Mongiello, M. (2022). Digital age of consent and age verification: Can they protect children? *IEEE Software*, 39(3):50–57. DOI: https://doi.org/10.1109/MS.2020.3044872.

Penina, M. (2017). Telas e crianças: conheça os mitos e riscos desta exposição. (accessed 25 April 2023).

UNICEF (2019). Growing up in a connected world, unicef office of research – innocenti, florence. (accessed 25 April 2023).

A Mapping studies

ID	Study
S1	V. Gnanasekaran, K. De Moor, Usability, security, and privacy recommendations for mobile parental control, in: Proceedings of the 2023 European Interdisciplinary Cybersecurity Conference, EICC '23, Association for Computing Machinery, New York, NY, USA, 2023, p. 138–143. doi:https://doi.org/10.1145/3590777.3590800.
S2	H. H. Altarturi, M. Saadoon, N. B. Anuar, Cyber parental control: A bibliometric study, Children and Youth Services Review 116 (2020) 105134. doi:https://doi.org/10.1016/j.childyouth.2020.105134.
S3	W. Fuertes, K. Quimbiulco, F. Galarraga, J. L. Garcia-Dorado, On the development of advanced parental control tools, in: 2015 1st International Conference on Software Security and Assurance (ICSSA), 2015, pp. 1–6. doi:https://doi.org/10.1109/ICSSA.2015.011.
S4	A. K. Ghosh, K. Badillo-Urquiola, M. B. Rosson, H. Xu, J. M. Carroll, P. J. Wisniewski, A matter of control or safety? examining parental use of technical monitoring apps on teens' mobile devices, in: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems, CHI '18, Association for Computing Machinery, New York, NY, USA, 2018, p. 1–14. doi:https://doi.org/10.1145/3173574.3173768.
S5	E. Magkos, E. Kleisiari, P. Chanias, V. Giannakouris-Salalidis, Parental control and children's internet safety: the good, the bad and the ugly, Proc. ICIL 2014 18 (2014).
S6	M. Nouwen, M. Van Mechelen, B. Zaman, A value sensitive design approach to parental software for young children, in: Proceedings of the 14th International Conference on Interaction Design and Children, IDC '15, Association for Computing Machinery, New York, NY, USA, 2015, p. 363–366. doi:https://doi.org/10.1145/2771839.2771917.
S7	L. Rafferty, M. Fantinato, P. C. K. Hung, Privacy Requirements in Toy Computing, Springer International Publishing, Cham, 2015, pp. 141–173. doi:https://doi.org/10.1007/978-3-319-21323-1_8.
S8	G. Wang, J. Zhao, M. Van Kleek, N. Shadbolt, Protection or punishment? relating the design space of parental control apps and perceptions about them to support parenting for online safety, Proc. ACM Hum. Comput. Interact. 5 (2021). doi:https://doi.org/10.1145/3476084.
S9	A. Feal, P. Calciati, N. Vallina-Rodriguez, C. Troncoso, A. Gorla, et al., Angel or devil? a privacy study of mobile parental control apps, Proceedings of Privacy Enhancing Technologies (PoPETS) 2020 (2020).doi:https://doi.org/10.2478/popets-2020-0029.
S10	M. Ko, S. Choi, S. Yang, J. Lee, U. Lee, Familync: facilitating participatory parental mediation of adolescents' smartphone use, in: Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous computing, UbiComp '15, Association for Computing Machinery, New York, NY, USA, 2015, p. 867–878. doi:https://doi.org/10.1145/2750858.2804283.
S11	N. Sangal, D. Singhvi, M. Pharande, D. Patole, Teen-alyse: A mobile application for parental control, teen self-monitoring and active mediation, in: 2021 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), 2021, pp. 1–5. doi:https://doi.org/10.1109/ICRITO51393.2021.9596148.
S12	P. Wisniewski, A. K. Ghosh, H. Xu, M. B. Rosson, J. M. Carroll, Parental control vs. teen self-regulation: Is there a middle ground for mobile online safety?, in: Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing, CSCW '17, Association for Computing Machinery, New York, NY, USA, 2017, p. 51–69. doi:https://doi.org/10.1145/2998181.2998352.
S13	M. Nouwen, N. Jafarinaimi, B. Zaman, Parental controls: reimagining technologies for parent-child interaction, in: Proceedings of 21 15th European Conference on Computer-Supported Cooperative Work- Exploratory Papers, European Society for Socially Embedded Technologies (EUSSET), 2017, pp. 18–34. doi:https://doi.org/10.18420/ecscw2017-28.
S14	S. Wardhana, M. K. Sabariah, V. Effendy, D. S. Kusumo, User interface design model for parental control application on mobile smartphone using user centered design method, in: 2017 5th International Conference on Information and Communication Technology (ICoIC7), 2017, pp. 1–6. doi:https://doi.org/10.1109/ICoICT.2017.8074715
S15	O. d. P. Albuquerque, M. Fantinato, S. M. Peres, F. Iqbal, P. C. Hung, A conceptual model for a parental control tool for smart toys, in: 23rd International Conference on Artificial Intelligence, 2021, pp. 1–10
S16	L. Gonçalves de Carvalho., M. Medeiros Eler., Security requirements for smart toys, in: Proceedings of the 19th International Conference on Enterprise Information Systems - Volume 2: ICEIS, INSTICC, SciTePress, 2017, pp. 144–154. doi:https://doi.org/10.5220/0006337001440154.
S17	O. de Paula Albuquerque, M. Fantinato, P. C. Hung, S. M. Peres, F. Iqbal, U. Rehman, M. U. Shah, Recommendations for a smart toy parental control tool, The Journal of Supercomputing 78 (2022) 11156-11194. doi:https://doi.org/10.1007/s11227-022-04319-4.
S18	H. Ameur, A. Rekik, S. Jamoussi, A. B. Hamadou, Childprotect: A parental control application for tracking hostile surfing content, Entertainment Computing 44 (2023) 100517. doi:https://doi.org/10.1016/j.entcom.2022.100517.

ID	Study
S19	Z. Iftikhar, Q. R. u. Haq, O. Younus, T. Sardar, H. Arif, M. Javed, S. Shahid, Designing parental monitoring and control technology: A systematic review, in: C. Ardito, R. Lanzilotti, A. Malizia, H. Petrie, A. Piccinno, G. Desolda, K. Inkpen (Eds.), Human-Computer Interaction – INTERACT 2021, Springer International Publishing, Cham, 2021, pp. 676–700.
S20	K. Badillo-Urquiola, D. Smriti, B. McNally, E. Golub, E. Bonsignore, P. J. Wisniewski, Stranger danger! social media app features co-designed with children to keep them safe online, in: Proceedings of the 18th ACM International Conference on Interaction Design and Children, IDC '19, Association for Computing Machinery, New York, NY, USA, 2019, p. 394–406. doi:https://doi.org/10.1145/3311927.3323133.
S21	Y. Hashish, A. Bunt, J. E. Young, Involving children in content control: a collaborative and education-oriented content filtering approach, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '14, Association for Computing Machinery, New York, NY, USA, 2014, p. 1797–1806. doi:https://doi.org/10.1145/2556288.2557128.
S22	S. Yardi, A. Bruckman, Social and technical challenges in parenting teens' social media use, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '11, Association for Computing Machinery, New York, NY, USA, 2011, p. 3237–3246. doi:https://doi.org/10.1145/1978942.1979422.
S23	L. Zhang-Kennedy, C. Mekhail, Y. Abdelaziz, S. Chiasson, From nosy little brothers to stranger-danger: Children and parents' perception of mobile threats, in: Proceedings of the The 15th International Conference on Interaction Design and Children, IDC '16, Association for Computing Machinery, New York, NY, USA, 2016, p. 388–399. doi:https://doi.org/10.1145/2930674.2930716.
S24	D. Sarwatay, J. Lee, D. B. V. Kaye, Exploring children's tiktok cultures in india: Negotiating access, uses, and experiences under restrictive parental mediation, Media International Australia 186 (2023) 48–65.doi:https://doi.org/10.1177/1329878X221127037.
S25	A. MAFTEI, I.-A. MERLICI, How should children and adolescents use digital devices in a healthy manner, and how should parents employ digital control?, International Journal of Social and Educational Innovation (IJSEIro) 10 (2023) 134–165.
S26	M. Kumar, V. Dwivedi, A. Sanyal, P. Bhatt, R. Koshariya, Parental security control: A tool for monitoring and securing children's online activities., in: Proceedings of the 2021 Thirteenth International Conference on Contemporary Computing, IC3-2021, Association for Computing Machinery, New York, NY, USA, 2021, p. 469–474. doi:https://doi.org/10.1145/3474124.3474196.
S27	Marsh, An Examination of Parenting Strategies for Children's Online Safety), Ph.D. thesis, Carnegie Mellon University, Pittsburgh, PA, USA, 2018. doi:https://doi.org/10.1184/R1/7188881.v1.
S28	M. Stoev, D. K. Sarmah, Online protection for children using a developed parental monitoring tool, in: X.-S. Yang, R. S. Sherratt, N. Dey, A. Joshi (Eds.), Proceedings of Eighth international Congress on Information and Communication Technology, Springer Nature Singapore, Singapore, 2023, pp. 205–215. doi:https://doi.org/10.1007/978-981-99-3243-6_17.
S29	P. Dias, R. Brito, Criteria for selecting apps: Debating the perceptions of young children, parents and industry stakeholders, Computers & Education 165 (2021) 104134. doi:https://doi.org/10.1016/j.compedu.2021.104134.
S30	S. Çankaya, H. F. Odabasi, Parental controls on children's computer and internet use, Procedia - Social and Behavioral Sciences 1 (2009) 1105–1109. doi:https://doi.org/10.1016/j.sbspro.2009.01.199, world Conference on Educational Sciences: New Trends and Issues in Educational Sciences.
S31	B. McNally, P. Kumar, C. Hordatt, M. L. Mauriello, S. Naik, L. Norooz, A. Shorter, E. Golub, A. Druin, Co-designing mobile online safety applications with children, in: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems, CHI '18, Association for Computing Machinery, New York, NY, USA, 2018, p. 1–9. doi:https://doi.org/10.1145/3173574.3174097.
S32	T. Warner, C. Meadows, P. Wahjudi, Analysis, recognition, monitoring, and reporting tool (armr), Journal of Management & Engineering Integration (2012).
S33	M. B. Mariya Stoilova, S. Livingstone, Do parental control tools fulfil family expectations for child protection? a rapid evidence review of the contexts and outcomes of use, Journal of Children and Media 18 (2024) 29–49. doi:https://doi.org/10.1080/17482798.2023.2265512.